

Chapter Two: Property Description and Petroleum Potential

Table of Contents

Chapter Two: Property Description and Petroleum Potential.....	2-1
A. Property Description.....	2-1
B. Surface and Subsurface Ownership	2-1
C. Geology.....	2-3
C. Petroleum Potential.....	2-4

Chapter Two: Property Description and Petroleum Potential

A. Property Description

The study area encompasses 1,866,240 acres, which are entirely within the Matanuska-Susitna Borough (Mat-Su Borough). The borough has the powers of taxation, land management and zoning and is responsible for providing borough communities with public works, utilities, education, health, and other public services. Residents use the area for recreation and for subsistence, personal use and sport hunting and gathering. The state is the predominant landowner in Area One. Other institutional landowners include the Mat-Su Borough, Cook Inlet Region Incorporated, village corporations, Mental Health Trust, and the University of Alaska (see Figure 2.1). Private land holdings include subdivisions, homesites, Native allotments, homesteads, and mining claims (ADF&G, 1985b:875).

B. Surface and Subsurface Ownership

There are two types of interests or ownership in land: the surface estate and the subsurface or mineral estate. In many areas of the United States an original owner may hold an interest in both the surface and subsurface estates. This is especially true when the original owner was a settler or homesteader. The interests may become separated when an original owner keeps only the surface estate and sells (or leases) the subsurface, or when an owner sells only the surface and keeps the subsurface to sell or use later. Therefore surface and subsurface interests may be separate, and a property or homebuyer could buy land but acquire only the surface estate.

In United States common law, the subsurface estate is the dominant estate. However, the subsurface interest must give "due regard" to the surface estate owner and the surface owner might be entitled to compensation for property damage.

When Congress was debating the Alaska Statehood Act, a major concern expressed was how the new state, which was one of the poorest in the country, could support itself since it did not have an industrial base. As a result, the Alaska Statehood Act allowed the state of Alaska to select from the federal public domain 104 million acres of land as an economic base for the new state. The Act also granted to Alaska the right to all minerals underlying these selections and specifically required the state to retain this mineral interest when conveying interests in the surface estate. The Statehood Act provided that if Alaska disposed of its mineral estate contrary to the Act it would have to forfeit that mineral estate to the federal government. The lands offered for exploration licensing contain lands in which the state owns both the surface and subsurface estate, and lands where the state owns only the subsurface while the surface might be either privately owned or held by the borough.

Under Alaska state law AS 38.05.125, licensees of oil and gas interests have the right to enter upon the surface estate for the purposes of exploration and development. However, a licensee of the subsurface must give "due regard" to the surface estate owner and may not enter the surface estate until the licensee makes a good faith effort to reach agreement with the surface estate owner on a settlement for damages that might be caused by license activities (AS 38.05.130). If an agreement cannot be reached, the licensee may enter upon the land in exercise of the state's reserved rights only after posting a surety bond for an amount determined to be sufficient by the director of DO&G. Governmental powers to regulate oil and gas activity are discussed in Chapter One. AS 38.05.130 contains information regarding bonding requirements.

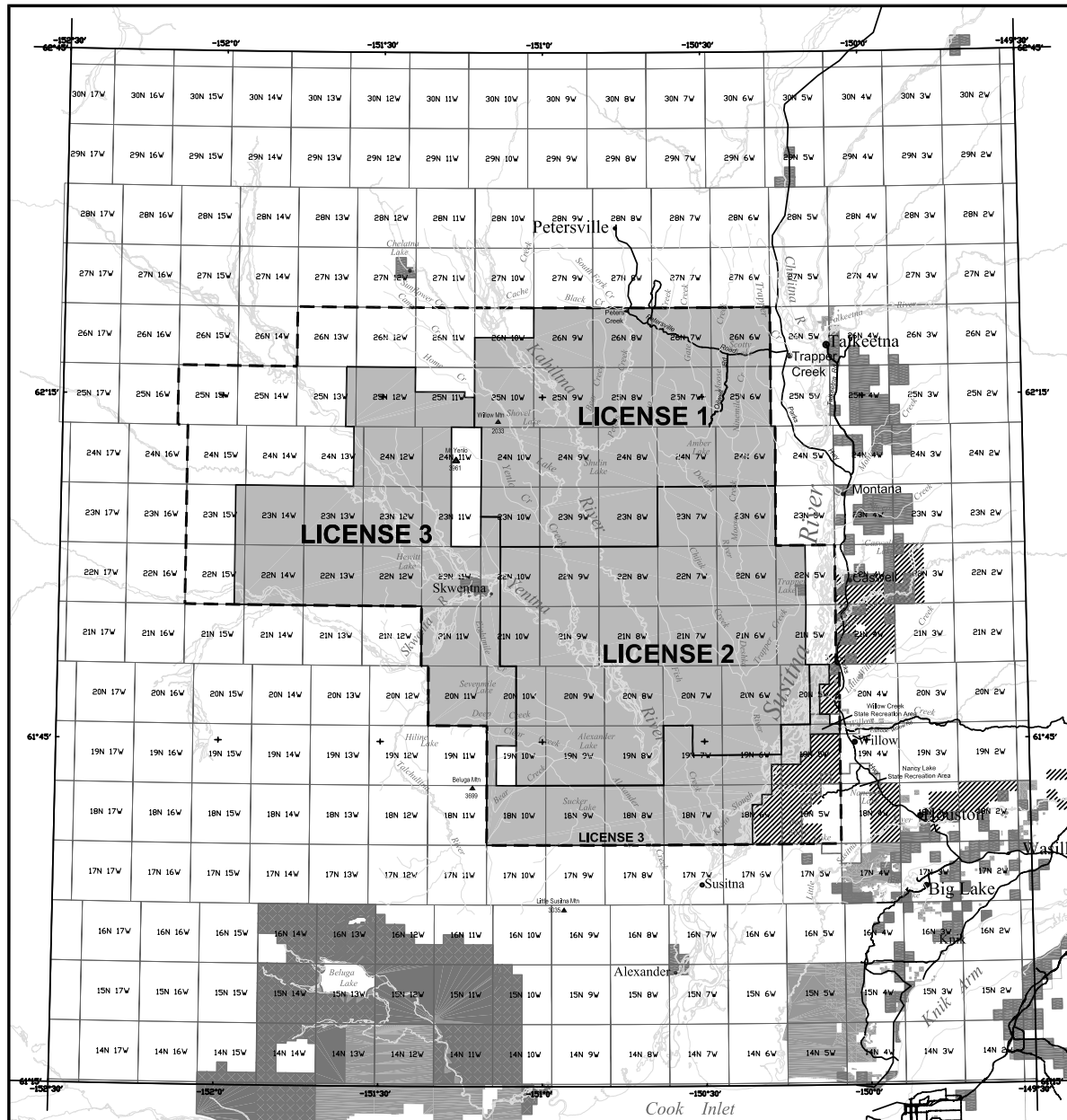
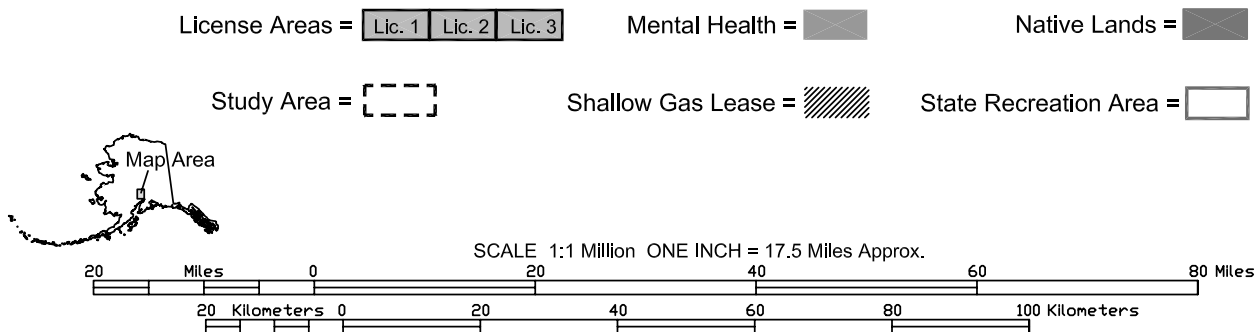


FIGURE 2.1 Susitna Basin Exploration License Areas: General Land Status



Map created, edited, and published by the State of Alaska, Department of Natural Resources, Division of Oil and Gas.
 Albers Equal-Area Conic Projection, 1927 North American Datum, Clarke 1866 ellipsoid with a central meridian of 151°, origin latitude of 50°, northern parallel of 65°, and southern parallel of 55°.

C. Geology

The Susitna basin is located near the edge of a geologically active zone of convergence between two tectonic plates, the Pacific (an oceanic plate) and the North American (a continental plate). Continental land masses typically are either inactive regions of old rocks, such as central Canada, areas of passive sediment accumulation, such as the Gulf Coast of the United States, or active belts of mountain building, characteristic of southcentral Alaska. (Strahler & Strahler, 1984)

Continental and ocean basin materials make up the earth's crust, which rides or floats as tectonic plates on the planet's semi-molten mantle. Where these plates meet, they either move in opposite directions as with mid-ocean rifting, slide past each other as in California, or collide as in southcentral Alaska. When plates collide, some of the less dense silica-rich continental materials are manipulated, faulted and folded into mountains, while more dense oceanic basalt and remaining silicon-rich rocks are subducted and move back toward the earth's hot mantle. Melted subducted rocks then rise and generate volcanic plumes near plate boundaries.

The origins and evolution of all continental materials are important to understanding geology. Igneous rocks cool at or near the earth's surface and form the material for two other rock types. Metamorphic rocks are formed and reformed, physically, chemically and molecularly altered by increased heat and pressure. Sedimentary rocks, like shale and sandstone, are derived from the decomposition and disintegration of older rocks. The resultant material is deposited as sediment, which is then compacted through burial. Petroleum and natural gas are generated by, and almost always found in, sedimentary rocks.

During the late Paleozoic and early Mesozoic time (see Table 2.1), sediments were deposited in a sea that occupied the southcentral region of Alaska. A volcanic island arc occupied a widespread area in the general vicinity of the now existing Alaska Range, erupting lava and volcanic materials into adjacent areas. The area occupied by the island arc was deformed and uplifted during Triassic time, providing a source of sediments that were deposited to the south in the adjacent marine basin (AEIDC, 1974:41 and Ryherd, 1997)

Table 2.1 Geologic Time

Eras	Periods	Epochs	Began Approximate Number of Years Ago
Cenozoic	Quaternary	Holocene (Recent)	10,000
		Pleistocene (Glacial)	1 million
	Tertiary	Pliocene	7 million
		Miocene	25 million
		Oligocene	40 million
		Eocene	60 million
		Paleocene	68-70 million
Mesozoic	Cretaceous	Late and Early	135 million
	Jurassic		180 million
	Triassic		225 million
Paleozoic	Permian		270 million
	Pennsylvanian		325 million
	Mississippian		350 million
	Devonian		400 million
	Silurian		440 million
	Ordovician		500 million
	Cambrian		600 million

AEIDC, 1974:37

Uplift and erosion of the Alaska Range during Jurassic and Cretaceous times provided the material for a thick sequence of continental shelf sediments deposited in an adjacent, low lying basin which extended from the southern Alaskan Peninsula through the Cook Inlet region to the Copper River basin. Here fine-grained sediments rich in organic material were deposited along with conglomerates, sands and clays, providing the possible source beds and reservoir rocks for the Tertiary petroleum reservoirs of the Susitna basin (AEIDC, 1974:41 and Ryherd, 1997).

During the Tertiary Period in the Susitna basin, deposition of sand and gravel alternated with luxuriant swamp vegetation growth. Through this repetitive cycle of vegetative growth and sediment deposition, peat layers were developed and buried, producing present-day coal formations. The sands and gravels would later become oil and gas reservoirs (AEIDC, 1974:41).

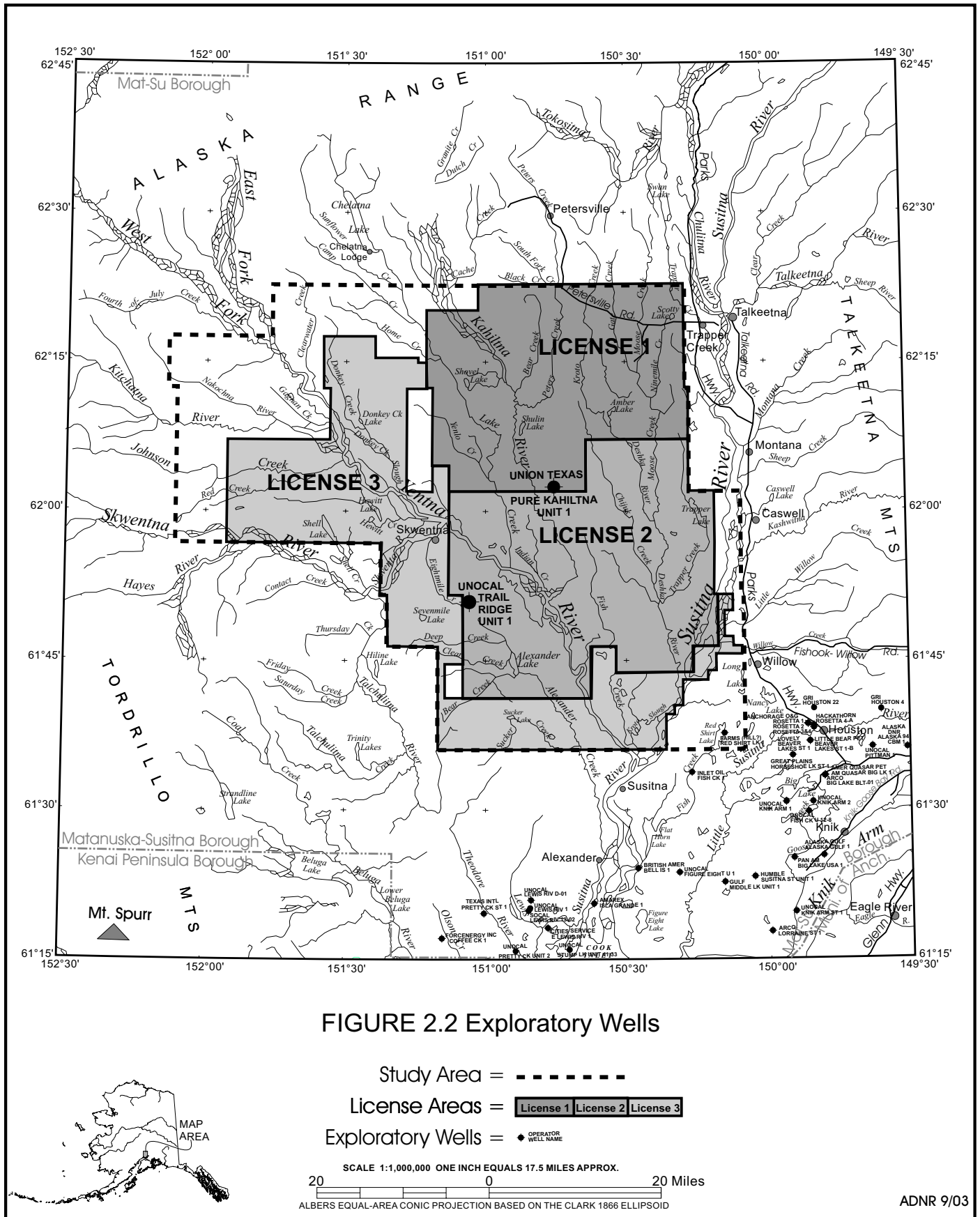
The Susitna basin is interpreted as a northern extension of the Cook Inlet basin. It is separated from the Cook Inlet basin by the Castle Mountain fault, a major regional structural feature of southcentral Alaska. The sedimentary section north of the Castle Mountain Fault is about 2,000 feet thick, while south of the fault it is estimated to be at least 20,000 feet thick (Maynard, 1987 and Ryherd, 1997). The structural style of the Susitna basin is a combination of graben and half-graben basement faulting. The Tertiary sedimentary fill consists of largely the same formations as are found in Cook Inlet. However, Eocene-age West Foreland Formation and Oligocene age Hemlock Conglomerate reservoir rocks appear to be missing in the Susitna basin. It is significant that the Jurassic oil-prone source rock found in the Cook Inlet basin have not been found in Susitna basin wells or outcrops (Ryherd, 1997). The presence of dry gas source rocks in the Susitna basin, similar to those found in the Cook Inlet basin, and the apparent absence of equivalent oil-prone source rocks indicate that the potential for finding gas in the Susitna basin is much greater than for finding oil. (Ryherd, 1997)

The Susitna basin has not been extensively explored. Nine oil and gas exploration wells and four core holes have been drilled in this region. All exploration wells were plugged and abandoned as dry holes, though some did have minor gas shows. The two wells drilled near the deepest part of the basin were the Union Texas Pure Kahiltna Unit #1, completed in March 1964 to a total depth of 7,265 feet, and the Unocal Trail Ridge Unit #1, completed in October 1980 to 13,708 feet. Both wells bottomed in possibly the Talkeetna Formation, volcanic rocks. Coal beds become prominent in the lower part of both of these wells, suggesting a correlation with the coal-bearing formations in the Cook Inlet basin that produce natural gas (Ryherd, 1997).

Turner and Wescott (1982) report that the granitic rocks beneath Houston are continuous with the Tertiary-to-Cretaceous-age granitic batholith of the Talkeetna Mountains. Up to 2,000 feet of coal-bearing Tertiary-age sedimentary rocks overly the granitic bedrock in the Farms Red Shirt Lake #1 and Inlet oil Fish Creek #1 wells.

C. Petroleum Potential

For an accumulation of hydrocarbons to be recoverable, the underlying geology must be favorable. This will depend on the presence of source and reservoir rock; the depth and time of burial; and the presence of migration routes and geologic traps or reservoirs. Source rocks are organic rich sediments, generally marine shales, which have been buried for a sufficient time, and with sufficient temperature and pressure to form hydrocarbons. As hydrocarbons are formed, they will naturally progress toward the surface if a migration route exists. An example of a migration route might be a permeable layer of rock in contact with the source layer, or fault fractures that penetrate organic rich sediments. A hydrocarbon reservoir is permeable rock that has been geologically sealed at the correct time to form a "trap." The presence of migration routes therefore affects the depth and location where oil or gas may pool and form a reservoir. For a hydrocarbon



The Susitna basin has low to moderate petroleum potential. This represents ADNR's general assessment of the oil and gas potential of the area and is based on a resource evaluation made by the state. This resource evaluation involves several factors including geology, seismic and well engineering data, exploration history of the area, and proximity to known hydrocarbon accumulations. In order to protect the seismic and well engineering data, which are kept confidential under AS 38.05.035(a)(9)(C), the division must generalize the assessment that is made public